

CHAPTER 3

Resource Analysis

Several methods and sources were used and consulted during the analysis phase of the developing this Plan including:

- Review of the analysis and results from the 1998 UEC Water Supply Plan.
- Review of consumptive use permitting activities and related data that have occurred since the acceptance of the 1998 UEC Water Supply Plan.
- Implementation of the 1998 UEC Water Supply Plan.
- Review and input from the public.
- Data and results from the CERP Indian River Lagoon – South Project.

The purpose of this chapter is to summarize the analysis that was used to support this 2004 Plan Update. This analysis was used to identify potential water supply related issues (potential problems) that may occur in developing historically used water sources to meet year 2025 projected water demands in the Upper East Coast (UEC) Planning Area. Potential issues as a result of this analysis are described in **Chapter 4** of this document. The process and information used for issue identification are described along with the results. The results are summarized in the form of a list of issues that this Plan needs to address and resolve.

Water source options, potential implementation and strategies to resolve these issues are discussed in **Chapter 5** (Meeting and Managing Future Water Demands). For each water source option, a definition, summary of the public workshop discussion, estimated costs, quantity of water anticipated to be made available from that option, as well as implementation strategies to facilitate development of that option are listed. In addition, regional recommendations are described and costed (total and annualized) by task, designated to a funding source and consigned to the entity/agency responsible for its implementation, in **Chapter 6**.

CHAPTER 373 RESOURCE PROTECTION TOOLS AND LEVEL OF CERTAINTY

Before discussing planning area specifics, it is important to understand the relationship between the different levels of harm referred to in statutes and various SFWMD resource protection programs. The overall purpose of Chapter 373 of the Florida Statutes (F.S.) is to ensure the sustainability of water resources of the state (Section 373.016, F.S.). To carry out this responsibility, Chapter 373 provides the SFWMD with several tools, with varying levels of resource protection standards. Protection programs include the SFWMD's surface water management and consumptive use permitting regulatory programs, minimum flows and levels (MFLs) and the SFWMD's Water Shortage Program. Determination of the role of each of these and the protection that they offer are discussed in Chapter 4 of the *DRAFT Consolidated Water Supply Plan Support Document*.

1998 UEC WATER SUPPLY PLAN

The SFWMD's Governing Board approved the first *Upper East Coast Water Supply Plan* in February 1998 (1998 UEC Water Supply Plan or 1998 Plan). The 1998 Plan had a 2020-planning horizon. An advisory committee was established to provide public input throughout development of the 1998 Plan. The 1998 Plan incorporated regional groundwater modeling as part of its analysis. The demand projections, assumptions and resource protection criteria used in that analysis were reviewed and compared to current information. It was determined that the conclusions of the 1998 Plan are applicable with the current planning horizon of 2025.

Staff and the public recognized the findings and conclusions of the 1998 Plan as still representative of the issues in meeting the UEC Planning Area 2025 projected water demands; and, that they should be considered in the development of the *2004 Upper East Coast Water Supply Plan Update* (2004 Update), in combination with other methods as described. It was concluded that the modeling associated with 1998 Plan is congruent with the 2025 scenario for the 2004 Plan Update.

1998 UEC Water Supply Plan Level of Certainty

The 1998 UEC Water Supply Plan incorporated a 1-in-10 level of certainty for all users, including natural systems. The 1-in-10 level of certainty was based on a twelve-month cumulative drought rainfall event, which statistically occurs once every 10 years. This certainty level was simulated in models for St. Lucie and Martin counties and is consistent with the level of certainty goal contained in the statutory requirements. The methodology used in determining the 1-in-10 year drought event in the 1998 Plan is described in that Plan's Appendix C, and a similar discussion of methodology is provided

in Appendix D of this 2004 Update. The demand projections and resource protection criteria incorporated the 1-in-10 level of certainty.

1998 UEC Water Supply Plan Demands

The water demand projections in the 1998 UEC Water Supply Plan were compared with projections developed for the 2025 planning horizon in the 2004 Update. The 1998 Plan incorporated a planning horizon of 2020. Population projections in the 1998 Plan were based on population projections contained in local government comprehensive plans. The 2004 Update uses the 2025 medium range population projections, as published by the University of Florida Bureau of Economic and Business Research (BEBR, 2002). The 2025 projections have been compared to recent updates of local government comprehensive plans, where available, and have been found to be similar. Local governments and utilities have also reviewed them.

In both plans, irrigated acreage was based on historical growth patterns. Irrigation demands in the 1998 Plan were determined using the modified Blaney-Criddle method as described in the *Basis of Review for Consumptive Use Permitting* (SFWMD, 1997) using a 1-in-10 year drought event. In the 2004 Update, the Agricultural Field Scale Irrigation Requirement Simulation (AFSIRS) model was used. Appendix G of the 1998 Plan and Appendix A of this 2004 Update contain additional information regarding the projection and demand methodologies used in each plan.

The results of this comparison concluded that the total average water demand projections in the 1998 Plan for 2020 are almost twice as high as those projected for 2025 in the 2004 Update. The total average water demands projected for 2020 in the 1998 Plan were 565 MGD; whereas, the total average water demands projected for 2025 in the 2004 Update are 277 MGD. This reduction in total demand is attributed primarily to a lower estimate for irrigated agricultural acreage; the 1998 Plan anticipated a significant increase in citrus acreage, whereas the 2004 Update, based on trends since 1998, anticipates a modest decline. With the exception of the public water supply and commercial and industrial self-supply categories, all water uses in the 1998 Plan had higher projections for 2020 than the 2004 Update has for 2025 as indicated in **Chapter 2** of this document.

1998 UEC Water Supply Plan Resource Protection Criteria

Resource protection criteria in the 1998 UEC Water Supply Plan were designed to prevent harm to the resources up to a 1-in-10 year drought event. For drought conditions greater than a 1-in-10 event, it may be necessary to decrease water withdrawals to avoid causing significant and serious harm to the resource. Water shortage triggers or water levels, at which phased restrictions are declared, can be used to curtail withdrawals by water use types. These restrictions avoid water levels declining to and below a level where serious harm to the resource could potentially occur. The framework of water use permitting, reservations, minimum flows and levels and water shortage practices are

further explained in Chapter 4 of the *DRAFT Consolidated Water Supply Plan Support Document*.

Two resource protection criteria were used in the 1998 Plan: wetland protection criterion and Floridan Aquifer protection criterion. These criteria were intended to be equivalent to the existing water use permitting guidelines. For the 1998 Plan, the criteria were defined in terms of water levels, duration, frequency of drawdowns and a 1-in-10 year drought event in order to assess the potential impacts (harm) of cumulative water use on the environment and groundwater resources using the groundwater modeling tools. Vulnerability mapping was used to identify areas with the greatest potential for saltwater intrusion.

In the planning context, the resource protection criteria are guidelines to identify areas where there is the potential for cumulative water use withdrawals to cause harm to wetlands and groundwater resources. Areas where simulations indicate the resource protection criteria were exceeded during the selected level of certainty are areas where the water resource may not be sufficient to support the projected demand under the given constraints.

Wetland Protection Criterion

The wetland protection criterion was defined in the 1998 UEC Water Supply Plan as follows: Groundwater level drawdowns induced by cumulative pumping withdrawals in areas that are classified as a wetland should not exceed 1.0 foot at the edge of the wetland for more than one month during a 12-month drought condition that occurs as frequently as once every 10 years. The wetland coverage used in the 1998 Plan was developed using information from the 1984 National Wetlands Inventory (NWI). Using 1990 and 1991 satellite images and aerial photographs, the SFWMD updated the NWI data.

In 2003, the SFWMD's Governing Board approved a substantial change to wetland impact evaluation criteria contained in the Basis of Review for Water Use Permit Applications within the SFWMD (Basis of Review). This criterion is used to determine whether or not a permit applicant satisfies the conditions for issuance of a water use permit. Essentially, applicants must demonstrate that their proposed use will not cause harm to wetlands. The standards define three categories of wetlands from natural lakes, deep ponds and cypress strands that are permanently flooded throughout the year, except in cases of extreme drought (Category 1); to seasonally inundated wetlands including cypress domes, emergent marshes, cypress strands, mixed hardwood swamps or shrub swamps and exhibit standing water conditions throughout most of the year (Category 2); to temporarily flooded and saturated wetlands including wet prairies and shallow emergent marshes, as well as seepage slopes, bayheads, hydric hammocks and hydric flatwoods (Category 3). Most of the wetlands in the UEC Planning Area are Category 2 wetlands.

To demonstrate that no harm will occur to wetlands and other surface waters, the applicant must provide reasonable assurances that the narrative standard for Category 1, 2 and 3 wetlands are met. For Category 2 wetlands, the criteria states that the narrative standard is met by complying with a numeric threshold, unless it is deemed by the SFWMD to be inapplicable due to site specific considerations. The numeric threshold states that the water use shall not be considered harmful when the modeled drawdown resulting from cumulative withdrawals in the unconfined aquifer beneath all portions of the wetland is less than 1.0 foot. The standards require that water use withdrawals be modeled based on a maximum monthly allocation simulated for 90 days without recharge, for situations where an analytic simulation is utilized. This is sometimes referred to as the “90 day no recharge” standard. In the 1998 Plan, it was demonstrated that the wetland protection criterion based on a 1-in-10 year drought was consistent with the “90 day no recharge” standard. For more complex systems, calibrated numeric system simulation models may need to be used. In such instances, the model run must use a series of steps with various rainfall and demands, including a 12-month period of 1-in-10 year drought conditions. Given the underlying parallels between the 1998 Plan wetland protection criterion and the criterion that is incorporated into the Basis of Review, the SFWMD’s planning and permitting criterion for wetland protection was determined to be consistent.

Floridan Aquifer Protection Criterion

The Floridan Aquifer protection criterion was defined in the 1998 UEC Water Supply Plan as follows: Groundwater level drawdowns induced by water use withdrawals should not cause water levels in the Floridan Aquifer to fall below land surface any time during a 12-month drought condition that occurs as frequently as once every 10 years.

The upper Floridan Aquifer is an artesian aquifer in the UEC Planning Area. The water quality in formations below the upper Floridan Aquifer is of lower quality (salinity is higher). If the water level in the upper Floridan Aquifer is allowed to decline below acceptable levels, upconing of this underlying lower quality water could occur at an unacceptable rate, causing water quality degradation in the upper Floridan Aquifer. This could eventually lower the water quality in the upper Floridan to a level unsuitable for current users. This protection criterion was established to protect the quality and sustainability of the upper portion of the Floridan Aquifer (upper Floridan Aquifer, generally 800 feet below land surface in the UEC Planning Area), and to avoid impacts to existing users.

The SFWMD’s Water Use Permitting Program rules relating to aquifer protection have recently been updated and continue prohibiting pumps on all Floridan wells in Martin and St. Lucie counties that increase water withdrawals greater than would occur naturally. This prohibition is related to the concern of potential upconing of higher salinity water and to avoid impacts to existing legal users. Impacts include the potential decline in water quality and a loss in head or water levels reducing the water available for use. Presently, there is insufficient data to conclusively define the relationship between water use, water levels and water quality. Also, the naturally occurring flow of the

Floridan Aquifer has been sufficient to meet the needs of the region's users. As such, water levels in the Floridan cannot decline below land surface. Therefore, the Floridan Aquifer protection criterion used in this Plan is equivalent to the intent of the existing Consumptive Use Permitting (CUP) Program. This criterion relates to the use of the Floridan Aquifer as a water source, but does not address the use of the Floridan Aquifer for aquifer storage and recovery (ASR) purposes.

Summary of 1998 UEC Water Supply Plan Analytical Tools

Analytical tools used in the 1998 Plan analysis included surface water budgets, numerical groundwater models and vulnerability mapping. Surface water budgets were used to approximate surface water availability in each of the major surface water basins in order to quantify the demands that could not be satisfied by surface water. The groundwater models were used to identify potential impacts of water use on the environment and groundwater resources. Vulnerability mapping was used to identify areas where there is the potential for future saltwater intrusion in the Surficial Aquifer System. A process diagram of the analytical tools used in the UEC Water Supply Plan is located in **Figure 5**.

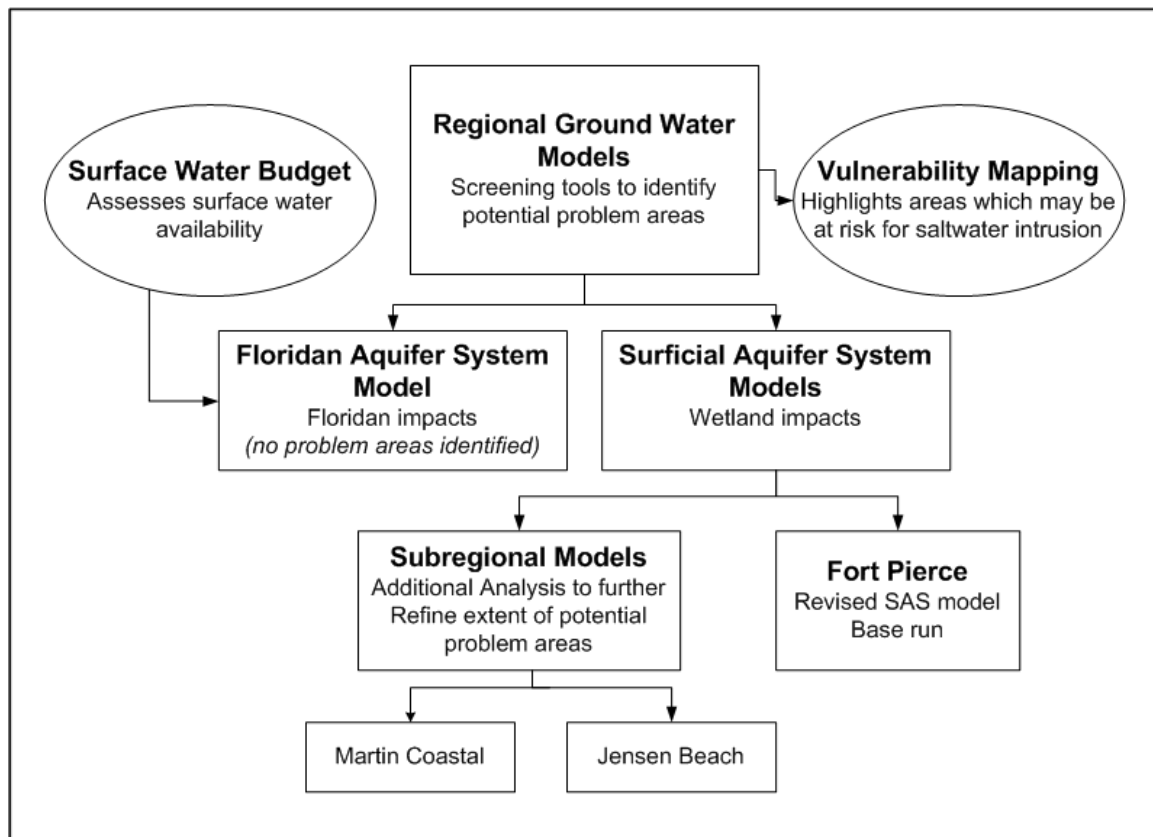


Figure 5. 1998 UEC Water Supply Plan Process Diagram and Analytical Tools.

Surface Water Budgets

Surface water budgets were used to assess surface water availability for water supply in each of the major surface water basins in the UEC Planning Area (C-23, C-24, C-25, North Fork St. Lucie River, Tidal St. Lucie), except the C-44 Basin. The surface water budgets indicate whether there is a surplus or deficit of surface water in each of the major canal basins for the rainfall event chosen. A deficit of surface water would indicate there is insufficient surface water to meet demands. For a given surface water basin, the budget considers the inflows and outflows that affect surface water storage. If inflows exceed outflows, then surface water is sufficient to meet the surface water demand. Unmet surface water needs were distributed to available groundwater sources, primarily the Floridan Aquifer.

As minimum flows and levels had not yet been established, the surface water budgets did not include minimum flows to the St. Lucie Estuary and Indian River Lagoon. A discussion of minimum flows and levels is provided later in this chapter. In addition, there are numerous combinations of potential solutions to meet the minimum flow, which were evaluated in the CERP Indian River Lagoon – South Project.

Groundwater Models

Groundwater models used in the development of the 1998 UEC Water Supply Plan included regional and subregional models. Regional groundwater models were used as screening tools to identify areas where water use, based on historical water sources and existing and proposed withdrawal facilities, has the potential of causing harm to the environment or aquifer during a 1-in-10 year drought condition. In locations where there were concentrated areas of potential impacts, more detailed analyses were conducted.

Based on the regional modeling results, three Surficial Aquifer areas in the UEC Planning Area were identified for additional analysis: 1) the Jensen Beach Area; 2) the Martin Coastal Area; and 3) the Fort Pierce Area. For the Jensen Beach and Martin Coastal areas, finer resolution subregional “zoom” groundwater models were used to conduct the additional analysis. The Fort Pierce Area was examined in more detail using the regional SAS model with refined inputs. **Figure 6** indicates the areas encompassed by the regional groundwater models and the areas that required additional analysis.

Both the regional and subregional groundwater models used the U.S. Geological Survey (USGS) modular three-dimensional finite difference groundwater flow model, commonly known as MODFLOW. The area encompassed by the model is divided into cells by a model grid (defined by a system of rows and columns). The groundwater models generate two principal types of output, computed water levels, which result from the conditions simulated, and water budgets for each active cell. The water budget shows the inflows and outflows for each of the cells. More detailed information on these models is available in the *1998 UEC Water Supply Plan Support Document and Appendices*.

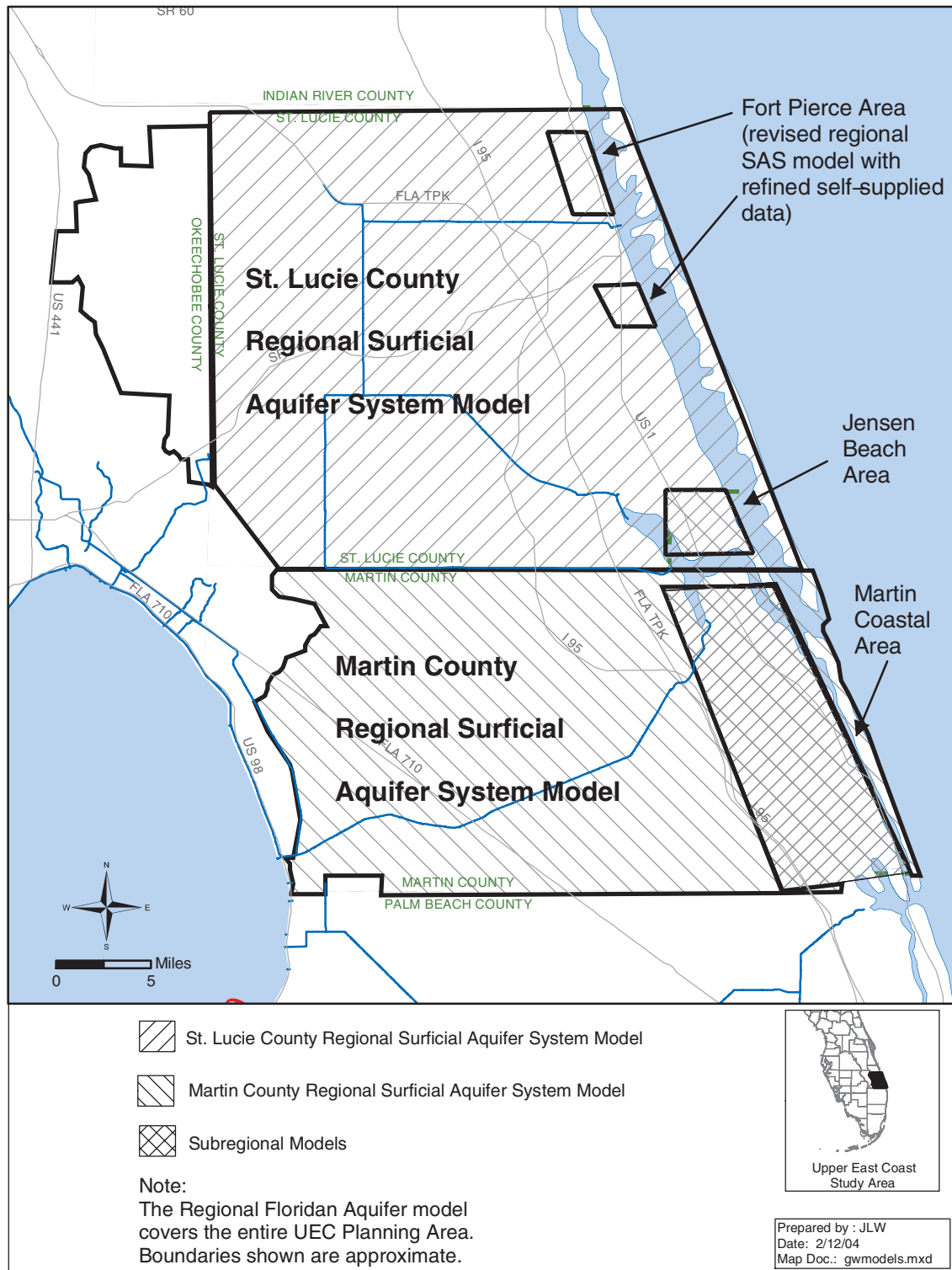


Figure 6. Regional Groundwater Modeling and Subregional Areas.

All the groundwater models were peer-reviewed for their appropriateness and reasonableness. The reviewers concluded the modeling was acceptable, the post-calibration modeling activities were reasonable, and that the overall groundwater modeling effort was appropriate for development of this water supply plan.

Regional Groundwater Models

Three regional groundwater models were used to simulate the potential impacts of water use in the UEC Planning Area: 1) the Martin County Surficial Aquifer System (SAS) Model; 2) the St. Lucie County SAS Model; and, 3) the Floridan Aquifer System (FAS) Model, which encompasses the entire UEC Planning Area. The SAS models are comprised of 2,000-by-2,000-feet cells, while the FAS model is comprised of 1-by-1-mile cells.

These regional models were developed by District staff and documented in peer-reviewed technical publications prior to their use in the UEC Water Supply Plan effort. The regional models were updated to reflect 1990 and future water use demands.

Subregional Groundwater Models

Aside from the regional models, two finer resolution subregional SAS models were used for the Jensen Beach Area and Martin Coastal Area to determine if the potential impacts were an artifact of the scale of the regional models or water use. The ability of the groundwater models to reflect the actual ground location of a withdrawal is a function of the cell size or scale used in the model. All withdrawals (wells) that fall within the boundaries of a cell are viewed as coming from the center of that cell, regardless of their specific location. Because of this, as cell sizes are decreased, withdrawals are placed closer to their actual position. The same holds true for the position of wetlands. Consequently, by using the finer scale models, the models more closely represent actual conditions.

The Jensen Beach Area subregional SAS model (Jensen Beach model) was an existing model developed by District staff and documented in a peer-reviewed technical publication (SFWMD, 1991b) and the model's data sets were updated for this planning effort. The Jensen Beach model encompasses the Jensen Beach peninsula in Martin County and is comprised of 240-by-240-feet cells. Approximately 69 Jensen Beach model cells fit into one regional model cell.

The Martin Coastal Area subregional SAS model (Martin Coastal model) was developed during the planning process. The Martin Coastal model encompasses the area from the St. Lucie River south to the Loxahatchee River, and from the Atlantic Ocean west to the Florida turnpike, and is comprised of 500-by-500-feet cells. Approximately 16 Martin Coastal model cells fit into one regional model cell. This model is further described in Appendix J of the 1998 Plan.

Vulnerability Mapping

Vulnerability mapping is a technique used to identify potential problem areas, especially in water resource investigations, by weighting key factors that can cause the problem. It was used in the 1998 UEC Water Supply Plan to evaluate the potential for saltwater intrusion. The factors used in this evaluation were: water levels, proximity to salt water and historic changes in chloride concentrations. Several of these factors were outputs from the regional SAS models. Vulnerability mapping for this application highlights areas that have the highest potential for saltwater intrusion relative to the rest of the region. It does not determine areas that have or will have saltwater intrusion.

The inland movement of salt water is a major resource concern in the coastal areas of the UEC Planning Area and can significantly affect water availability in areas adjacent to saline water bodies. When water is withdrawn from the Surficial Aquifer at a rate that exceeds its recharge capacity, the amount of freshwater head available to impede the migration of salt water is reduced, and saltwater intrusion becomes likely. Saltwater intrusion was identified in Hobe Sound, resulting in several wells being taken out of service.

Historically, the SFWMD's CUP Program has required water users to maintain a minimum of 1.0 foot of freshwater head between their wellfields and saline water as a guideline for the prevention of saltwater intrusion, among others. This guideline, in combination with a saltwater intrusion monitoring program, has been largely successful in preventing saltwater intrusion in the UEC Planning Area. Much of this effort has been carried out on a permit-by-permit basis. The approach taken in the water supply plan is intended to provide a comprehensive view of the potential for saltwater intrusion within the region. By identifying those areas most vulnerable to saltwater intrusion, the plan provides users and regulators with a foundation to take a strong proactive approach in managing saltwater intrusion.

Summary of 1998 UEC Water Supply Plan Modeling and Results

The results of the 1998 UEC Water Supply Plan indicated that historically used sources of water, primarily the SAS in the urban coastal areas, are not adequate to meet the growing needs of the UEC Planning Area during a 1-in-10 year drought condition. Potential impacts on wetlands, as well as the potential for saltwater intrusion, increase using estimated future demand levels. However, with diversification of supply sources (e.g., Floridan Aquifer, reclaimed water, etc.), the analysis indicated the existing and future water demands could be met with minimal potential impacts.

The results of the surface water budget analysis verified that the surface water availability during a 1-in-10 year drought condition under the existing canal and storage network is not adequate to support the water supply demands on them. However, supplementing these surface water supplies with groundwater sources, primarily the Floridan Aquifer, was shown to be sufficient to meet the existing and future demands.

Considering a worst-case scenario, existing and future public water supply demands were transferred to the FAS for one of the model simulations. This is in addition to the users already projected to be using the Floridan Aquifer to meet future demands. In an extreme case, if the utilities choose to use the Floridan Aquifer to meet future demands, the Floridan would most likely only supplement, not replace, their existing SAS withdrawals. As a result, actual Floridan withdrawals are expected to be less than evaluated. The results of this analysis indicate there would be no resource protection criterion exceedances if all projected public water supplies met the entire demand with Floridan Aquifer water.

The 1998 Plan concluded that future public water supply demands could be met with a combination of SAS water and FAS water without causing harm to the resources during a 1-in-10 year drought condition. Urban landscape irrigation demands could be met with a combination of SAS water and reclaimed water. Some further development of the SAS can be accomplished in these areas at the local level through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. Additional withdrawals from the SAS in these coastal areas will have to be evaluated on a project-by-project basis.

For agriculture, primarily citrus, it was concluded that surface water, supplemented with Floridan Aquifer water during extended periods of low rainfall, is sufficient to meet the projected needs during a 1-in-10 year drought. Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project is expected to enhance surface water availability. The CERP will determine quantities available for the natural systems, as well as human uses.

It was agreed that freshwater discharges (minimums and maximums) are affecting the health of the St. Lucie Estuary and the Indian River Lagoon, as well as being lost to tide. The CERP Indian River Lagoon – South Project will address freshwater discharges to the St. Lucie Estuary and increase surface water availability for water use. The Ten Mile Creek project, initiated in 2003, will address freshwater flows in the Ten Mile Creek Basin.

Several water resource options, and combinations of options, were evaluated to determine their potential effectiveness in meeting a portion of the projected demands and reducing potential exceedances. These source options included use of the FAS to meet public water supply demands, increased use of reclaimed water and increasing agricultural efficiency. Analysis of the Floridan Aquifer indicated the Floridan Aquifer could support the additional demands. The analysis found reducing demands on the SAS through the use of the Floridan system and reclaimed water in the coastal portions of the UEC Planning Area was very effective at reducing potential exceedances of the wetland protection and the potential for saltwater intrusion. Maximizing the use of the resources should incorporate more efficient use of water by increasing urban and agricultural water conservation.

For consistency between the 1998 UEC Water Supply Plan and the Water Use Permitting Program, it was recommended that the resource protection criteria and assumptions used in the 1998 Plan be incorporated into the SFWMD's Basis of Review for consumptive use permits. Additional research was also recommended to better understand the potential impacts to natural systems and to develop water shortage management strategies tied to the District's CUP Program.

1998 UEC Water Supply Plan Conclusions and Recommendations

The 1998 UEC Water Supply Plan concluded that historically used sources of water, primarily fresh groundwater sources, are not sufficient to meet the projected demands through the planning horizon. The 1998 Plan recommended new sources of water be explored and used to reduce the potential for harm to wetlands and the water resources, including the FAS, increased use of reclaimed water, increased water conservation and research to meet the projected demands. The 1998 Plan also recommended more efficient use of water by increasing urban and agricultural water conservation, and developing cost-sharing partnerships. The 1998 Plan analysis concluded that implementation of the above will significantly reduce the number of potential problems. To ensure the water needs of this region will be met over the next 20 years and beyond, the Plan contained 31 water resource development recommendations and 19 water supply suggestions.

1998 UEC Water Supply Plan Implementation

The recommendations in the 1998 UEC Water Supply Plan are being realized. The following are summaries of the implementation of some of the 1998 Plan recommendation areas.

Floridan Use

Most coastal public water supply utilities have begun transitioning to the Floridan Aquifer in addition to continued use by the citrus industry. The utilities in the UEC Planning Area that use, or are developing the Floridan Aquifer for future demands, include South Martin Regional, Martin County North, Martin County Tropical Farms, Port St. Lucie and Fort Pierce Utilities Authority.

Table 11 shows that use of the Floridan Aquifer is increasing by public water supply utilities in both Martin and St. Lucie counties. In 2000, the use of the Floridan Aquifer by utilities accounted for 20 percent of the total utilities withdrawal in the UEC Planning Area. This is an increase from the 1998 usage of 16 percent of the total. This trend is anticipated to continue as most of the utilities in the region plan to use the Floridan Aquifer in the future. In some areas of the region, utilities have decreased Surficial Aquifer withdrawals with development of the Floridan Aquifer.

Table 11. Public Water Supply Water Sources and Use (MGD) 1998–2000.

	1998	1999	2000
Floridan Aquifer			
Total	5.09	6.57	8.48
% of Total	16%	18%	20%
Surficial Aquifer			
Total	27.28	30.52	34.72
% of Total	84%	82%	80%
Total Use	32.37	37.09	43.20

Source: USGS, 2001

Reclaimed Water

The use of reclaimed water in the planning area in 2002 has increased to over 9.3 MGD (FDEP, 2003). The volume of reclaimed water that is used for a beneficial purpose has almost doubled since 1994 in the region. Most new large irrigation needs are being met with reclaimed water where it is available. This trend is projected to continue with the projects underway, or proposed by utilities in the region. Some local governments are also developing mandatory reuse zones that will require new developments to use reclaimed water as part of their development orders.

SFWMD Funding Programs

The SFWMD provides funding assistance to water users for development of alternative water supplies and water conservation through two cost-share programs, the Alternative Water Supply Funding Program and the Water Savings Incentive Program.

Alternative Water Supply Funding Program. The SFWMD has continued funding of alternative water supply projects through the Alternative Water Supply Funding Program. The SFWMD has provided about \$3.1 million for 21 alternative water supply projects in the UEC Planning Area between 1998 and 2004. These included 12 projects related to development of the Floridan Aquifer and reverse osmosis treatment, seven water reuse projects and two stormwater reuse projects. These projects produce over 32 MGD of additional water supply.

Water Savings Incentive Program. The Water Savings Incentive Program (WaterSIP) was established by the SFWMD in Fiscal Year (FY) 2002 to provide cost-share funding for the implementation of water saving projects that reduce urban water usage. The WaterSIP focuses on non-capital projects, such as the installation of automatic shutoff devices for irrigation systems and plumbing retrofits. In two years, this program has provided \$700,000 for 19 projects Districtwide. No projects in the UEC Planning Area were submitted for consideration of funding.

Mobile Irrigation Labs

The SFWMD co-funds two urban Mobile Irrigation Labs (MILs) in the UEC Planning Area to complement an existing agricultural lab. The urban MILs provide homeowners, condominium associations, golf courses and public buildings and parks with on-site analyses, system evaluations and water quality evaluations. The Martin and St. Lucie labs were established in 1998 and 1999, respectively, as a result of recommendations in the 1998 Plan. Each urban MIL completes approximately 140 evaluations per year, with a potential water savings of 50 to 60 million gallons of water per year (about .30 MGD) and an associated reduction in lawn chemicals and fertilizers leaving sites as runoff. There is one agricultural lab in the region funded by U.S. Department of Agriculture – Natural Resources Conservation Service (USDA–NRCS) that serves both St. Lucie and Martin counties. The agricultural lab performed 31 evaluations in FY 2002 and saved about 3.30 MGD.

Citrus Irrigation Conversion

Conversion of flood-irrigated citrus to microirrigation has continued since the 1998 Plan. In the 1998 Plan, it was estimated that 70 percent of the citrus in the region was using microirrigation. Today, information indicates this number has increased to over 80 percent. Flood irrigation has an efficiency of 50 percent, while microirrigation has an efficiency of 85 percent.



Citrus Grove

Floridan Aquifer Monitoring Network

As a result of the 1998 UEC Water Supply Plan, Floridan Aquifer monitoring programs in the UEC Planning Area were reviewed and combined into a comprehensive monitoring network. The District established a comprehensive monitoring network to collect data on water quality, water levels and water use in the Floridan Aquifer to gain a better understanding of the relationship between these three components important to planning. The comprehensive Floridan Aquifer monitoring well network consists of 31 monitoring locations distributed across the UEC Planning Area. There are 12 District locations (14 monitoring wells) that are monitored for water levels and water quality. The remaining 19 locations (52 monitoring wells) are monitored and sampled for water levels, water quality and water use under contract with the St. Lucie Soil and Water Conservation District. Data collection to determine trends and relationships is ongoing. A report summarizing the design and implementation of the network along with some of the initial findings are included in Appendix E of this 2004 Update.

The SFWMD also co-funded a study with the USGS to evaluate potential water quality changes and the distribution of salinity in the Floridan Aquifer. The final report

from this study is scheduled for release in mid-2004. The aim of the study was to identify potential sources of high salinity and possible flow mechanisms or pathways of groundwater to wells, and describe areas with a high potential of increased salinity. The study found that heads in the aquifer in central and northern St. Lucie County and Okeechobee County had declined substantially within recent years (2 to 4 feet in the past 15 years, 15 to 20 feet since predevelopment times). The head declines coincide with areas of intense agricultural use. These inland areas also have some structural deformations in the rock that could present exceptional pathways for groundwater flow. An area of elevated chloride concentration exists inland trending northwest through north-central Martin County and western St. Lucie County. The preliminary findings of the investigation indicate that the highest potential for upward or lateral movement of the saltwater interface is in the inland areas of St. Lucie County and Okeechobee County because of large declines in hydraulic head, areas of structural deformation and areas of higher salinity.

Wetland Drawdown Study

The SFWMD completed its wetland drawdown study as recommended in the 1998 Plan. The District began formulating a research plan to support development of wetland drawdown criteria in 1995. The purpose of this study was to implement hydrobiological monitoring at various wetland sites throughout the SFWMD to determine the effects of groundwater drawdowns on these systems. Twenty sites in four study areas were established and instrumented in 1997, including several in the UEC Planning Area. Additional sites were added in 1999. Data collection and analysis has been conducted to determine the relationship between variations in hydrology and wetland functions. These data were used to support development of wetland protection criteria in the SFWMD's Basis of Review for Water Use Permit Applications.

Rulemaking

The 1998 Plan contained recommendations to incorporate certain aspects of that plan, such as the resource protection criteria, level of certainty, special designations and permit durations into the Basis of Review for Water Use Permit Applications. The SFWMD has accomplished this through adoption of rule amendments in 2003. Specifically, an exhaustive series of rulemaking efforts was completed in September 2003 and resulted in amendments to Chapters 40E-1, 40E-2, 40E-5, 40E-8, 40E-20, 40E-21, Florida Administrative Code (F.A.C.) and the Basis of Review for Water Use Permit Applications within the SFWMD. Many important criteria affecting water use permitting were amended through these rulemaking efforts. Among the most significant changes were the amendments to permit duration, permit renewal, wetland protection, supplemental irrigation requirements, saltwater intrusion, aquifer storage and recovery and model evaluations criteria. Adoption of these rule changes is particularly important as the irrigation permit expiration and renewal process begins. Irrigation class water use permits within the UEC Planning Area began the renewal process in fall of 2003. The UEC Planning Area is the first region within the SFWMD to undergo the irrigation permit expiration and renewal process. The renewal process for the UEC Planning Area

should be completed by October 2004. The newly adopted criteria listed previously will apply to all applications for new and renewals of irrigation use class permits. The preceding rules, among others, can be found on the District's website available from http://www.sfwmd.gov/org/wsd/wateruse/wu_index.html.

Surface Water Storage

Regional surface water storage is being accomplished through three Everglades Restoration projects in the region: the CERP Indian River Lagoon – South Project, Ten Mile Creek Critical Restoration Project and CERP North Palm Beach County Part 1 Project. These projects, when implemented, will: 1) restore the Indian River Lagoon, St. Lucie Estuary and Loxahatchee River to a healthier state, and 2) provide water to agricultural users, after environmental needs have been met. These projects are being cost-shared between the SFWMD and the U.S. Army Corps of Engineers.

CERP Indian River Lagoon – South Project. The purpose of the Indian River Lagoon – South Project is to improve surface water management in the C-23, C-24, C-25 and C-44 basins for habitat improvement in the St. Lucie River/Estuary and the Indian River Lagoon. The Final Indian River Lagoon – South Project Implementation Report (PIR) Public Notice was signed by the USACE in Atlanta in March 2004. The PIR will be submitted to the USACE Headquarters in Washington, D.C. for final review. Approvals are being sought to incorporate the Indian River Lagoon – South Project in the *Water Resource Development Act of 2004* (WRDA 2004). Construction could be initiated as early as 2006 and it would take six years to complete.

The recommended plan in the CERP Indian River Lagoon – South PIR provides over 135,000 acre-feet of storage via four reservoirs covering 12,610 acres. In addition, four stormwater treatment areas are proposed to reduce phosphorus and nitrogen. These treatment areas encompass 8,731 acres, and will provide 35,000 acre-feet of storage. Additionally, 92,130 acres of natural storage and treatment areas will provide over 30,000 acre-feet of storage. The project is expected to increase water availability by 26,300 acre-feet per year (23.48 MGD), which will result in a decrease in Floridan Aquifer usage for agriculture.



Indian River Lagoon

The recommended plan also incorporates the removal of 5,500 cubic yards of muck and the creation of 90 acres of artificial habitat. Integrated as a component

of the plan, the restoration of the North Fork floodplain includes reconnection of historic oxbows and acquisition of over 3,000 acres of floodplain.

Ten Mile Creek Critical Restoration Project. Construction of the Ten Mile Creek Restoration Project was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet). This project is located immediately west of the Varn (a.k.a. Gordy Road) Structure in St. Lucie County and will provide storage and treatment of storm water from the Ten Mile Creek Basin, the largest subbasin discharging to the North Fork of the St. Luce River. The Ten Mile Creek Critical Restoration Project could potentially make over 5 MGD of additional water available to agricultural users. The construction will take approximately two years to complete and will cost approximately \$26 million.

CERP North Palm Beach County Part 1 Project and Northern Palm Beach County Comprehensive Water Management Plan. The South Florida Water Management District Governing Board accepted the Northern Palm Beach County Comprehensive Water Management Plan in May 2002.

The District has purchased approximately 44,800 acre-feet of storage for the L-8 Reservoir in the southern L-8 Basin. Analysis is being undertaken through the CERP North Palm Beach County Part 1 Project, modeling initiatives to determine how much more storage will be needed in the future. Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This \$2.1 million spillway structure will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough. Construction of the G-161 Northlake Boulevard Structure began in 2004.

MINIMUM FLOWS AND LEVELS

Since publication of the 1998 Plan, minimum flows and levels (MFLs) have been established for two water resources in the UEC Planning Area: the St. Lucie River and Estuary and the Northwest Fork of the Loxahatchee River. The establishment process for each of these included compilation and analysis of existing information, scientific peer review, significant public participation and rulemaking. Minimum flow and levels are established by the SFWMD in Chapter 40E-8, F.A.C., Minimum Flows and Levels. Establishment of minimum flows and levels for the Loxahatchee River tributaries (Cypress Creek, Hobe Grove Ditch and Kitching Creek) is scheduled for 2007.

St. Lucie River and Estuary

The St. Lucie River and Estuary watershed are located in Martin and St. Lucie counties. It includes the North and South Forks of the St. Lucie River, several major drainage and irrigation canals, the surrounding watershed and the estuary. The watershed covers approximately 780 square miles, while the microtidal estuary covers about 9.2 square miles. The River's headwaters lie between the lands west of Fort Pierce in St. Lucie County to near the north boundary of Jonathan Dickinson State Park in Martin County. Several creeks and canals that flow into either the North Fork or South Fork of the St. Lucie River, before entering the Indian River Lagoon near the St. Lucie Inlet, drain the natural watershed. This system is of particular importance because it lies at the confluence of two major transportation waterways. It is located adjacent to the Indian River Lagoon (part of the National Estuary Program), and provides an outlet for discharge of excess water from Lake Okeechobee.



St. Lucie Inlet

Excess Discharges to the St. Lucie River and Estuary

For the St. Lucie River and Estuary, extended periods of large volume, freshwater flows also impact the resource. Methods to reduce the volume and frequency of these releases therefore need to be considered. Various projects are proposed as part of the CERP Indian River Lagoon – South Project to increase storage, redistribute flows, provide additional water for irrigation and reduce the amount of excess runoff discharged to the Estuary. Projects within CERP and adjustments to the Lake Okeechobee regulation schedule will provide a means to reduce the amount of excess water discharged to the coast from Lake Okeechobee. Setting a minimum flow is viewed as a starting point to define minimum water needs necessary to protect water resources against significant harm.

Minimum Flow and Level for the St. Lucie River and Estuary

The SFWMD's Governing Board established a minimum flow and level for the St. Lucie River and Estuary in 2002. The minimum flow criteria for the St. Lucie River and Estuary are linked to the concept of protecting valued ecosystem components (VEC) from significant harm. The VEC components identified for the St. Lucie River and Estuary are the assemblage of organisms inhabiting the low salinity, oligohaline zone. The minimum flow and level criteria for the St. Lucie River and Estuary were based on the determination that significant harm occurs to the oligohaline zone when net freshwater flows (sum of surface and groundwater inflows minus evaporation) to the

estuary are at or below zero for a period of two consecutive months for two or more years in succession. The *Technical Documentation to Support Development of Minimum Flows and Levels for the St. Lucie River and Estuary* is available on the District's website at www.sfwmd.gov/org/wsd/mfl/index.html.

Based on this, a MFL violation occurs in the St. Lucie Estuary when mean monthly flows to the St. Lucie Estuary fall below 28 cubic feet per second from the Gordy Road Structure to the North Fork of the St. Lucie River for two consecutive months during a 365-day period, for two consecutive years.

St. Lucie River and Estuary MFL Prevention Strategy

Although the river and estuary presently receive an adequate supply of fresh water, and are expected to continue to do so as the CERP Plan is implemented, a prevention strategy may be required to protect this resource. The ability to better manage water in the watershed may also make it possible to capture and retain water from the watershed for allocation to other users (e.g., urban and agricultural water supply). Prevention strategy components for the North and South Forks to not cause significant harm to the St. Lucie River and Estuary are:

- Discharges from the North Fork will be managed within the operational protocols of the Ten Mile Creek Project scheduled to be completed by 2004. Flow targets will be consistent with the CERP performance requirements for the Indian River Lagoon.
- A research and monitoring strategy for the North and South Forks of the St. Lucie River will be developed and implemented in coordination with the Upper East Coast Water Supply Plan Update.

Northwest Fork of the Loxahatchee River

The SFWMD's Governing Board established a minimum flow and level for the Northwest Fork of the Loxahatchee River in 2002. The Loxahatchee River and Estuary watershed is located in Martin and Palm Beach counties. It includes the Northwest, Southwest and North Forks of the Loxahatchee River, a major drainage canal (C-18), the surrounding watershed and the estuary. The Northwest Fork was designated as Florida's first Wild and Scenic River in 1985. It is located at the southern end of the Indian River Lagoon (part of the National Estuary Program), and includes a state park and an aquatic preserve.

Minimum Flow and Level for Northwest Fork of the Loxahatchee River

The MFL criteria for the Northwest Fork of the Loxahatchee River were developed to protect the remaining floodplain swamp community and downstream estuarine resources from significant harm. Due to the lack of recent flow or biological data from the North Fork, the inability to regulate flow from the North Fork and the

highly altered nature of the Southwest Fork, these two arms of the Loxahatchee Estuary were not considered for MFL establishment at this time.

The minimum flow criteria for the Northwest Fork were linked to the concept of protecting VEC from significant harm. The VEC identified for the Northwest Fork is the Loxahatchee River's freshwater floodplain swamp. An assemblage of six freshwater tree species and associated vegetation community parameters were identified that characterizes the VEC. The Loxahatchee River National Wild and Scenic River Management Plan identified the floodplain swamp and its associated cypress forest as a resource of outstanding value that needs to be protected. Since cypress trees themselves appear to tolerate a wide range of salinity conditions and are slow to show a response to salinity stress, researchers at the SFWMD identified six species of freshwater swamp trees that, as a group, appear to be a more sensitive indicator of adverse salinity conditions. Protection of these species will assure that major constituents of the freshwater floodplain swamp community are also protected from significant harm. The *Technical Documentation to Support Development of Minimum Flows and Levels for the Loxahatchee River* is available on the District's website at www.sfwmd.gov/org/wsd/mfl/index.html.

Analysis of recent historical flow data indicated that an enhanced freshwater regime is necessary to prevent significant harm to the water resources and ecology of the Northwest Fork of the Loxahatchee River, pursuant to Sections 373.042 and 373.0421, F.S. By establishing the MFL, along with implementation of the associated recovery strategy, it is the interim goal of the District to provide sufficient freshwater flows to create at river mile 9.2 the freshwater conditions found at River Mile 10.2. A MFL violation occurs within the Northwest Fork of the Loxahatchee River when an exceedance happens more than once in a six-year period. A MFL exceedance occurs within the Northwest Fork of the Loxahatchee River when:

- Flows over Lainhart Dam decline below 35 cubic feet per second (cfs) for more than 20 consecutive days; or
- The average daily salinity concentration expressed as a 20-day rolling average exceeds two parts per thousand at river mile 9.2.

In addition to this MFL, which is intended to achieve partial enhancement of the Northwest Fork of the Loxahatchee River to prevent significant harm, restoration of the Loxahatchee River beyond the MFL will be addressed pursuant to Rule 40E-8.421(6), F.A.C. and other applicable provisions of state law. This MFL will be reviewed within two years of adoption and revised, if necessary, to ensure consistency with the restoration goal and plan identified pursuant to Rule 40E-8.421, F.A.C. or other applicable provisions of state law.

Loxahatchee River MFL Recovery Strategy

The Northwest Fork of the Loxahatchee River is currently not meeting the MFL and requires implementation of a recovery strategy to achieve the MFL as soon as practicable, consistent with Section 373.0421, F.S. The recovery strategy consists of projects contained within the following approved plans: the Lower East Coast Regional Water Supply Plan (LEC Plan), CERP and the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP). Four phases of recovery are identified in the MFL Technical Document completed in November 2002, which are projected to increase flows to meet the MFL for the Northwest Fork of the Loxahatchee River. As part of the recovery strategy, consumptive use permitting and water shortage requirements in Chapters 40E-2 and 40E-21, F.A.C., shall apply to consumptive use direct and indirect withdrawals from surface and groundwater sources from the Northwest Fork of the Loxahatchee River, and those areas directly tributary to the Northwest Fork.



Loxahatchee River

In addition to implementing this MFL recovery strategy, the SFWMD has committed to restore freshwater flows to the Northwest Fork of the Loxahatchee River above the MFL through Chapter 373, F.S., and the CERP and its associated authorities. The SFWMD will continue to partner with the Florida Department of Environmental Protection (FDEP) in establishing a practical restoration goal and plan for the Loxahatchee River watershed. Recognizing that natural seasonal fluctuations in water flows are necessary to ensure that the functions of the Loxahatchee River are protected, this restoration goal and plan will include a more complete set of seasonally managed flow criteria for the river that are driven primarily by natural rainfall and runoff patterns within the watershed.

The SFWMD will continue to operate the G-92 Structure and associated structures to provide approximately 50 cfs or more over Lainhart Dam to the Northwest Fork of the Loxahatchee River, when the District determines that water supplies are available. It is the intent of the SFWMD to continue the current operational protocols of the G-92 Structure so as not to reduce the historical high, average and low flows as estimated over the 30-year period of rainfall record used as the basis for the MFL for the Northwest Fork of the Loxahatchee River. It is the District's intent to implement, along with other partners, projects to meet the practical restoration goal. Projects contained in CERP, the Lower East Coast Regional Water Supply Plan and the Northern Palm Beach County Comprehensive Water Management Plan will provide increased storage and conveyance within the basin with a goal of providing more water for restoration of the Northwest Fork of the Loxahatchee River. These projects include the G-160 (Loxahatchee Slough) and the G-161 (Northlake Boulevard) structures on the C-18 Canal, M Canal widening and 48,000 acre-feet of storage in the southern L-8 Basin.

To protect water made available for the recovery and restoration of the Loxahatchee River through implementation of these associated projects, the SFWMD intends to adopt water reservations, a resource tool, for the Loxahatchee River, pursuant to Subsection 373.223(4), F.S., on a project-by-project basis, over the next 20 years. In addition, the SFWMD intends to adopt an initial reservation to protect existing water used for protection of fish and wildlife, consistent with the practical restoration goal identified for the Loxahatchee River in 2004. Future reservations related to the Loxahatchee River will be consistent with the reservations being developed for restoration of the Everglades under CERP, and will reflect the needs of the natural system through a range of hydrologic conditions. These water reservations are intended to prevent the future allocation to consumptive uses of the fresh water needed for restoration of the Loxahatchee River. The reservations will be implemented through the District's CUP Program, operational protocols, water shortage rules and other appropriate provisions in Chapter 373, F.S.

As reservations are adopted to restore the Loxahatchee River beyond the level of protection achieved by the present MFL, the SFWMD shall revise the MFL and associated prevention and recovery strategy, as appropriate, under Sections 373.042 and 373.0421, F.S., to be consistent with the reservation.

ASSESSMENT OF THE 1998 UEC WATER SUPPLY PLAN

Taking into consideration the information and knowledge gained in developing the 1998 Plan, and the intelligence gained since its approval, it was concluded that the 1998 Plan analysis represents a very conservative scenario and is applicable to the 2025-planning horizon. This conclusion is based on several considerations:

- The projected water demands in the 2004 Update are considerably less than those projected in the 1998 Plan.
- Some of the potential problems that were identified on a regional scale in the 1998 Plan associated with 1990 withdrawals were not identified as issues or have been resolved on a local scale through the SFWMD's CUP Program.
- Water users have diversified their supply sources and reduced their reliance on the Surficial Aquifer. Most coastal utilities are utilizing the Floridan Aquifer to meet their future needs; reclaimed water use in the area has increased significantly and offsets use of groundwater; and conversion of flood irrigation to microirrigation has continued. Most of the recommendations in the 1998 have been implemented.
- The 1998 Plan analysis indicated that with diversification of supply sources, through development and expansion of alternative sources, exceedances were eliminated. Since the 1998 modeling and identification of these potential problem areas, additional work has been conducted related to these areas. Some of the factors examined

included projected demands, current land use, CUP experience, field inspection and the SFWMD's wetland drawdown study.

- The increased demand on the Floridan was simulated—all existing and future public water supply demands were transferred to the Floridan Aquifer for one of the model simulations. This is an extreme case in that if utilities choose to use the Floridan Aquifer to meet future demands, the Floridan would most likely only supplement, not replace, their existing SAS withdrawals. As a result, Floridan withdrawals are actually expected to be less than evaluated. The results of the 1998 Plan analyses indicated there would be no resource protection criterion exceedances if all utilities met their entire projected demand with Floridan Aquifer water.
- Projected 2025 irrigated agricultural acreage is approximately 19 percent less than those projected and simulated in the 1998 Plan. Irrigated agricultural acreage in the region is projected to decrease slightly from 2000 levels.
- Several applications for consumptive use permits in the potential problem areas have been approved since the 1998 Plan. Several of these projects required modification to wellfield locations and pumping regimes with respect to wetlands prior to approval. In other areas, aerial photography was reviewed over several decades and did not indicate changes in the size or vegetation of these systems. In addition, information collected as part of the SFWMD's wetland drawdown study suggests that seasonally inundated wetlands (a majority of the wetlands in the UEC Planning Area) are more sensitive to drawdowns during the wet season, rather than the dry season. The 1998 Plan analysis evaluated drawdowns based on a 12-month 1-in-10 year drought condition, and many potential problems were triggered on drawdowns that occurred during the dry season.
- The demand projections, assumptions and resource protection criteria used in the 1998 Plan analysis were reviewed and compared to current (2003) information and it was determined that the conclusions of the 1998 Plan are applicable today with the current planning horizon of 2025.

District staff and the public recognized that the findings and conclusions of the 1998 UEC Water Supply Plan are still representative of the issues involved in meeting the UEC Planning Area 2025 projected water demands. These findings will be considered in the development of the 2004 UEC Water Supply Plan Update. It was concluded that the analyses in the 1998 Plan is congruent with the 2025 scenario for the 2004 Plan.

